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Engineering

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OFFICIAL PROCEEDINGS
Meeting of February, 1919

Volume XVIII.

No. - - - 2

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INCORPORATED
OCTOBER
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Canadian Railway Club

MONTREAL

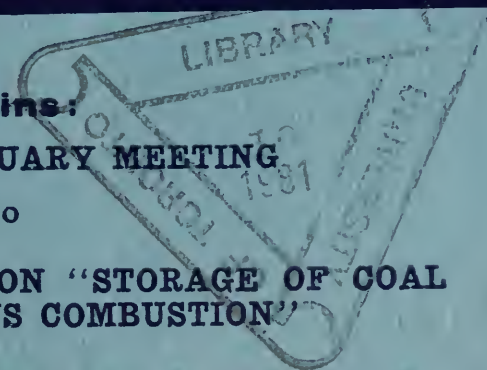


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REPORT OF FEBRUARY MEETING

ALSO

**PAPER AND DISCUSSION ON "STORAGE OF COAL
AND SPONTANEOUS COMBUSTION"**



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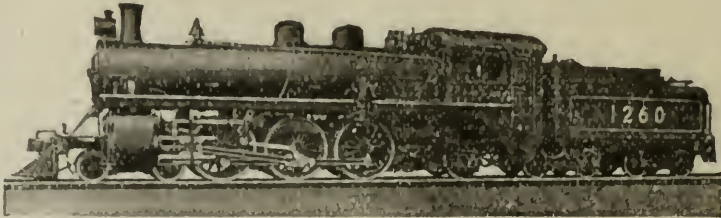
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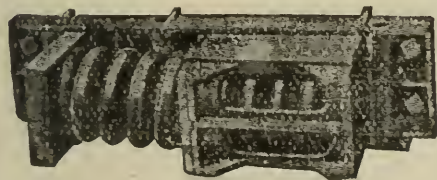
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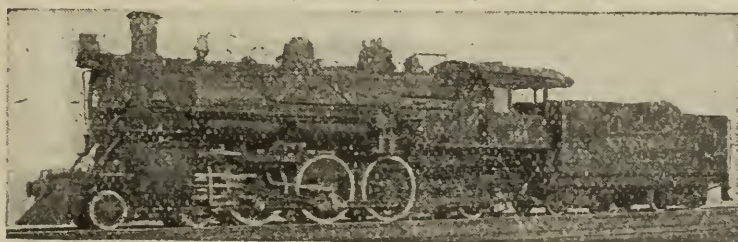
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Vol. XVIII.
No. 2

Montreal, Can. Feb. 11, 1919

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PROCEEDINGS OF THE CANADIAN RAILWAY CLUB.

Windsor Hotel, Montreal,
11th February, 1919.

The regular monthly meeting of the Canadian Railway Club was held at the Windsor Hotel on Tuesday the 11th day of February, 1919, at 3.30 p.m.

There were present:

Mr. E. A. Nix in the Chair and Messrs:—

J. R. Ayers	W. T. Hawes	S. H. Pudney
E. R. Battley	N. Holland	H. Rake
E. Beausoleil	W. E. Joyce	P. P. Reynolds
S. Blumenthal	F. J. Lamb	G. E. Rennell
L. A. Boucher	E. E. Lloyd	A. Riddington
P. A. Brooks	T. S. Kerr	J. M. Scott
H. J. Brown	C. Martin	C. F. Sherwood
L. Brown	M. J. Millar	T. Sleight
W. A. Buckle	W. Miller	G. R. Soltau
C. Burgin	A. E. Mimms	W. Spence
J. H. Burns	W. S. Morden	S. H. Spry
S. D. Campbell	F. Morin	H. P. Swinton
J. M. D. Carroll	J. Morris	H. H. Symmes
T. C. Chown	E. E. Moore	Hy. Taylor
R. L. Clarke	F. W. Moore	A. J. Thom
W. Cowap	E. C. McCracken	C. Tinkler
E. A. Cunningham	E. S. McMillan	J. E. Tinkler
C. R. Curry	E. S. M. McNab	C. M. Wells
H. J. Dyke	H. R. Naylor	F. R. Wickson
D. Desparois	H. Pearce	A. B. Wright
W. H. Estabrook	R. D. Peverley	J. J. York
L. J. Gibson	J. M. Primeau	Jas. Powell
E. J. Harvey	W. Prowse	and others
W. F. Harris	A. Pope	

Secretary:

Gentlemen: Our President has been called away from the

city on official business and will not be with us tonight. I will therefore ask Mr. E. A. Nix to take the chair.

Chairman (Mr. E. A. Nix) :

Gentlemen, please come to order. The first order of business is the roll call, but I believe it has been customary to dispense with that, and we will do so this evening, but I will ask that the members kindly fill out the cards which they will find in the seats in order that the Secretary may have a record of the attendance.

The next order of business is the reading of minutes of previous meeting. These have already been mailed to each members and no doubt you have received your copies.

Under the heading "Remarks of the President" there is nothing to say except that the President is absent tonight and I have no remarks to make.

I will now ask the Secretary to read the list of new members.

Secretary :

Mr. Chairman, the following applications have been received and passed upon by the Executive Committee :

NEW MEMBERS.

L. E. W. Bailey, Dearborn Chemical Co., Toronto.

W. H. Barry, 6 St. Helen Street, Montreal.

R. H. Black, Inspector, Motor Power Dept., Grand Trunk Railway, Montreal.

Geo. Bulkeley, Acting Motor Car Asst., Great Western Rly. Co., Slough, England.

H. E. Daniels, Manager, Railroad Sales Dept., West Despatch Co., 548 Railway Exchange, Chicago.

A. W. Sinnamon, Mechanical Engineer, 204 St. James St., Montreal.

C. B. Waters, Chief Engineer, Arcwell Corp., 42 Broadway, New York.

C. W. Blyth, Manager, Arcwell Corp. of Canada, 710 C. P. R. Building, Toronto.

E. Deschenes, Tool Supervisor. Montreal Locomotives Works, 1314 DesErables Street, Montreal.

F. E. Fox, Sec.-Treas., St. Lawrence Welding Co., 138 Inspector St. Montreal.

- D. J. Flynn, Electrical Foreman, C. P. R. Angus Shops, Montreal.
- B. C. Haskins, Roadmaster, Canadian National Rlys., Limoileu, P.Q.
- W. B. Northan, Dunlop Tire & Rubber Goods Co., 5 Fairview Ave., Toronto.
- G. B. Pickop, Mechanical Engineer, Malleable Iron Fitting Co., Bramford, Conn.
- H. C. Quimby, Asst. Road Foreman, G. T. Rly., Portland, Me.
- G. E. Renell, Locomotive Foreman, G. T. Rly., Island Pond, Vt.
- E. A. Robinson, 910 New Borks Bldg., Montreal.
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- N. P. Tracy, Dicisional Storekeeper, Canadian National Rlys., Limoileu, P.Q.
- T. H. Jack, Blacksmith Foreman, Canadian National Rlys., Limoileu, P.Q.
- H. W. Hughes, Freight Car Foreman, Canadian National Rlys., Limoileu, P.Q.
- L. Fortin, Boiler Shop Foreman, Canadian National Rlys., Limoileu, P.Q.
- A. Begin, Erecting Ehop Foreman, Canadian National Rlys., Limoileu, P.Q.
- W. F. Aves, Chief Electrician, Canadian National Rlys., Limoileu, P.Q.

Chairman:

You have heard the applications. What is your pleasure? I might say that they have already been passed upon by the Executive Committee.

Mr. Carroll:

I move that they be accepted.

Mr. Hunter:

Seconded.

Chairman:

It has been moved and seconded that these applications be accepted. All in favor please give the usual voting sign—Carried.

Secretary:

Under the heading of Standing Committees the only report due is that of the Dinner Committee. As you all know,

the Dinner was a great success, but the club is out of pocket about \$500.00 after all accounts are made up and receipts for all tickets sold turned in.

Chairman :

The next order is "Unfinished Business." Has any member anything to bring up under this heading or any new business? Is there any further discussion on the paper read at the last meeting? If not, we will pass along to the paper for this evening which is by Mr. S. H. Pudney, Fuel Inspector, C. P. R., on the Storage of Coal and Spontaneous Combustion. Mr. Pudney, will you please come forward?

STORAGE OF COAL AND SPONTANEOUS COMBUSTION.

By S. H. PUDNEY, Fuel Inspector, C. P. R.

The storage of coal is a subject worthy of everyone's attention these days. It is something that vitally interests those who of necessity, store coal for future use. There are hundreds of companies storing coal who never considered such a thing a few years ago. This is no doubt due to reasons that we are too well acquainted with to need much mention here. The war, shortage of labor and transportation are the chief reasons.

There are certain liabilities and risks run in the storage of coal, such as weathering, heating, even up to the point of fire, wastage in storage due to the lay-out of the ground, wastage and expense in unloading, wastage and expense in picking up again, all of which materially affect the cost of the fuel when used.

Some writers have claimed a large percentage of loss due to weathering; in fact, one prominent German—fifty years ago—said that it meant a 50% loss of the fuel. This was like a good many of the extravagant ideas of the Germans but it was the cause of others going into the matter with a view of finding out how much loss did occur during storage. Through a series of tests, it has been found that a very small percentage is lost; and, in fact, that most of the loss occurs during the first two weeks after the coal is mined, and that this loss is mostly due to the dissipation of gases that are contained in the coal the same as

water is contained in a sponge. These are called gases of occlusion. As to other losses due to weathering of the coal they are very small and from our own experience we find that coal taken from storage piles gives better service than new mined coal. At one time, our Angus Shops burned screenings on their chain grates taken from one of our dumps and got good results, but in the spring as soon as the new coal came along they experienced great trouble with clinkering fires and this with coal from the same mines as the dump coal. This is a feature that is very noticeable in storage coal; even coals that are especially liable to clinker lose some of this property in storage, which is due to the mineral elements in the ash becoming oxidised and preventing clinker formation.

The storage of coal under water has been advocated by some but this is impracticable in this climate, and it is doubtful if the efficiency gained would begin to cover the costs of installation of such storage plant, even in a warmer climate. Some favor storage of coal in small quantities to prevent overheating; this could not be entertained by railways and others using large quantities because the cost of storing in small piles and picking up again would make it prohibitive, and this system would have no protection against fires, as I have often found them within a few feet of the outside of the pile.

There is also a difference of opinion as to the right depth to store coal, but most coal will stand about 12 to 16 feet. I would much rather have the responsibility of one pile with 100,000 tons in it than five piles of 20,000 tons in them. I do not consider the danger any greater. A storage ground should be as nearly level as possible or better still, with a gentle slope. A turf ground makes a good bottom and very little loss occurs when the coal is picked up again from such a ground.

SPONTANEOUS COMBUSTION OF COAL.

This is something which gives a lot of trouble at times, and generally speaking, is a subject that is very little understood by the ordinary laymen. This is not to be wondered at when higher authorities who have made tests to determine its cause, together with scientists, differ so much in their views. One can hardly wonder that the layman without a knowledge of chemistry, and oftentimes with very little practical experience, understands so very little about

the cause of spontaneous combustion. Also as a rule, he understands very little as to the most practical manner of attacking a fire after it has started; this is mostly due to lack of the knowledge of the science of combustion.

In the first place, it would be as well to consider the cause of spontaneous combustion, and to do this, it is necessary to bring into the paper what some of the higher authorities have to say on this. Several investigations have been made by very eminent men, with a view of finding just what is the cause of it, but so far, not much practical knowledge has been given to the world at large. I do not think that any one with a very large pile of coal on his hands, nearing the point of fire, could get anything out of most of these reports of tests that would be of any benefit to him, and very little information could be obtained from them that would help him to prevent a fire. This is because these investigations have been made with small samples and under special conditions that do not obtain in ordinary practice. The testing of a small sample of a few grams of coal, powdered to an extreme fineness, and subjected to an atmosphere of pure oxygen, does not convey the least idea of what occurs in a pile of coal of 100,000 tons, containing all sizes and under atmospheric conditions.

There has been a great difference of opinion as to the cause of fire in coal piles during the last fifty years, and there is still the same difference to-day. For instance, some authorities say that sulphur has very little to do with it, if anything at all; again, others say that it has. Others say that the percentage of volatile matter has a great deal to do with it, and that coals very high in V. C. M. are more liable to fire than coals with a low percentage of V. C. M. Others say that the carbon content of the coal is the predominating feature.

After a good many years of practical experience, and with some knowledge of chemistry, I have come to a sort of theory; and I have yet to find anything to disprove or convince me that I am wrong. This has come about by close investigation into every fire that I have seen and studied in its various stages from heating, up to the point of actual fire, and these I propose to give in this paper with the hope that they will be of service to some of those present this evening.

I will take up the sulphur first. Despite the fact that its influence on spontaneous combustion is disputed, I am of the opinion that it is the element of greatest danger in the storing of coal. By the word sulphur, I do not include that

known as sulphur balls or true metallic pyrities. The sulphur in this form is very slow in its chemical changes, and not enough heat would be set up during this change, in a given time, to do any harm to a coal pile; in fact, it would disperse as fast as generated without being noticed. There are other forms of sulphur in coal which are dangerous and the most vital one is that where the bone coal, and small pieces of shale, are full of sulphur. In this form it very easily becomes oxidised, even if out in the open air. It is only a matter of a few days before one will see the sulphur cropping out all over these pieces, like a fungus growth, whitish in color. At any place near where the coal is heating, to such an extent that fire is expected to show up, this is so extensive, that in some places the surface of the coal pile is covered with sulphur out-croppings, that has through oxidation and moisture, been brought to the surface. This is more noticeable in some coals than others, and my experience is that these are the coals that are liable to spontaneous combustion.

With our system of ventilation we often find some of the holes choked completely with sulphur, so that it is impossible to put down our test rods until the holes have been remade. In one place where heat had set up to such a degree that the coal had reached the stage of autogenous oxidation, we had the coal dug out and found that though actual fire had not started, the heat had so far advanced that destructive distillation had begun, and gases were being liberated from the coal even from the centre of large lumps. Here, I found the coal surrounding the actual hot place, full of these small pieces of shale and bone yellow with sulphur, and an analysis showed 6.7% of sulphur while the average run of sulphur in this coal was less than 2%. There is no doubt in my mind as to what was the cause of the coal in this spot heating, and in several more spots in the same pile I found the same conditions, and as this pile was heating in spots and not regularly all over the pile, no one who had seen this pile and the conditions that prevailed, could have arrived at any other conclusion than that the sulphur was the direct cause of the heating. However, the presence of sulphur in coal cannot be controlled at well these days as formerly, due to the labor conditions. Coal is not picked quite so clean as in former years, which is the reason that more fires have occurred lately.

The liability of spontaneous combustion due to a greater percentage of V. C. M. in the coal, does not hold water for

one moment in actual practice; there are now quite a number of authorities who disclaim this feature. I gathered this knowledge from the fact that some of the coal we were handling easily caught fire with 35% of V. C. M. while others with over 40% did not have the slightest tendency to heat up, and the peculiar part of it is that they had about the same percentage of sulphur but that it was in a different form. Some authorities are of the opinion that spontaneous combustion is caused directly by the slow oxidation of the carbon content of the coal, and that the sulphur is only a secondary matter. If they were correct in such a statement, then we would be up against the proposition that all coal piles would be equally liable to catch fire, because all coal is chiefly composed of carbon, and its oxidation would be practically constant in all coal. Everyone that has had to do with storage of coal knows that some coals are more liable to heating than others, and this fact proves to the contrary the oxidation of the carbon theory. From my own actual practice, I am able to state that any fire that I have found has been caused by sulphur and not by oxidation and carbon. In places that have been dug out where the coal has been so hot that one could not hold it in the hand but had to hold it in a scoop to examine it, I found that the structure of the coal had not changed and was the same as when it was put in the pile, and yet there was bluish gas emanating from the piece of coal being examined. Now, if it had been oxidation of the carbon of the coal, which had caused the heat to set up, the structure of the coal would have been changed considerably before this amount of heat had obtained, while, on the other hand, is one was to take a lump of coal and place it in an oven and heat to about 300 degree and keep it there at that temperature, the same thing would be found, that the coal would be giving off a gas. In other words, destructive distillation would be started and this would be found to be not from the oxidation of the carbon content of the coal, but from the outside heat to which such coal had been subjected.

My own personal opinion is that sulphur is responsible for the trouble in coal piles. I feel that its rapid action in chemical changes is governed by the form in which it is contained in the coal. The power of fresh mined coal to absorb oxygen is well known, but there is doubt that the oxygen is contained in the coal, the same as water is contained in a sponge, and is a gas of occlusion and not chemically combined with the coal itself but held mechanically, and is given up to any chemical change that may occur which in this case is oxida-

tion of the sulphur. The sulphur starts to oxidize, and in this action a certain amount of heat is generated. This heat again in turn increases the chemical energy, the increase in chemical energy raising the temperature. These changes dovetail into one another gradually, until sufficient heat is generated to start destructive distillation of the coal at the same time. At this temperature, the coal is hot enough to start self oxidation, or in other words, the stage of autogenous oxidation is reached. It is then only a matter of a few days till actual fire occurs with coking of the coal.

One of the bad features in building coal piles and which we have found helps a lot towards spontaneous combustion, is when one is obliged to stop building the pile for any cause, leaving the face of the pile of fresh mined coal exposed to the influence of the sun and the atmosphere. In this way, it becomes loaded with oxygen and as soon as new coal is unloaded on top of it, the oxygen is given up in the chemical change that goes on with the sulphur and one may expect trouble from this part of the pile; in fact, we get it without expecting. Prevention is much better than cure in this case and coal piles should be ventilated if possible. The system in vogue on the C. P. R. we consider second to none.

The idea of where the benefit of ventilation comes in is rather vague to some, and one could get a dozen different views of it from as many men as handle coal, but the real benefit lies in the fact that when a coal pile is ventilated, it gives an opportunity for the heat to become dissipated. Coal usually has plenty of moisture in it, especially when unloaded in wet weather. The consequence is that as heat is mechanical energy, once it occurs we see its effect by the vapor coming out of the vent holes; all of this steam or vapor requires a given amount of energy to vaporize it, this then, is using up the heat that is being generated, and while this keeps up there is very little danger of fire.

Some imagine that a system of ventilation allows the gases to escape, but as there are no gases to escape until the coal has reached nearly the point of fire, this cannot be right. Our experience is that with coal wet or even fairly moist and ventilated there is no danger at all.

There seems to be no set rules for fighting a fire, nor do I think there could be, because conditions are not always alike, but a few suggestions as what not to do may not be amiss. Fires in a coal pile burn very slow, for the simple

reason that not enough air can reach the fire for rapid combustion. Therefore, never open up a fire spot. If the place is to be dug, dig close around it without touching the fire. Isolate it from the rest of the pile, then dig it out completely and drench it with water. It is one of the hardest things to prevent the inexperienced from opening up a fire. Fire will spread rapidly if opened up. Another thing very important, is that in using water on a coal fire, always saturate the coal surrounding the fire spot before putting water on the fire. If this is not done, the fire will be forced away from one faster than it can be reached. The reason for this is that the water going on to the actual fire, forces the heat into the surrounding coal which is nearly to the point of fire already, and at the same time it forms coke on the surface of the fire, into which it is impossible to force any more water, and meanwhile, the fire is still going ahead. It is absolutely ruinous to the rest of the pile to play water directly on to the fire, before putting a water screen around the outside of the fire spot first. It is very seldom that a direct application of water will put out a coal fire; and yet, I have put out a great many fires by application of water, after using the proper precautions, that is to say, by putting a water screen around the actual fire spot. At one time, with the assistance of two men, I put out a fire that measured 350 by 50 feet at its widest point and which would have practically gone through the 80,000 ton pile if it had not been stopped. This was done by finding the exact outer limits of the fire, then digging a shallow trench right along outside using water freely so as to put the water on the outside of the fire, then by systematically digging a relay of trenches coming nearer to the fire all the time we drove it to the outside of the pile and killed it completely. I might say that there was solid coke found to be six feet thick in this fire area, and the balance of the pile did not have to be touched.

Our mode of attacking a fire is to get our test rods out around the spot and find out the exact dimensions of it, then find at what depth it is. We then dig a trench around this spot making sure to keep outside of the fire spot, saturate this with water and make holes with rods and see that a complete water screen is put around the fire, then, by a series of trenches gradually working nearer to the fire; we reduce this area until we cover the exact spot where the fire is, and making holes with our rods we take care to well flood it with water and it is very seldom we have to return to the spot as it is usually completely extinguished.

Mr. Pudney:

I might say also that I have some samples here which I shall be pleased to show any one interested.

(Exhibits Samples).

(1) I might say here that storage under covering is of no material value in preventing coal from heating.

(2) This is a piece of metallic pyrites. It has been in the dump for the past eight months and is just as hard today as when put into it.

(3) Here is a sample which has been exposed to the air. You will note it is yellow with sulphur after being out about three weeks, while this (exhibiting another piece) is a sample just out of the car.

Chairman:

You have heard Mr. Pudney's paper on the Storage of Coal and Spontaneous Combustion. It is now open for discussion and I am sure Mr. Pudney will be only too glad to answer any questions that may be asked.

A Member:

I should like to ask Mr. Pudney to explain his system of ventilating coal.

Mr. Pudney:

Our system of ventilating piles is this: We build all our piles by raising the track until we get the desired height—this with the exception of Fort William at which point we did not have opportunity to expand and the coal was piled deeper. When the pile gets 16 ft. deep we slide the track over and leave a road for ventilating. We have steel rods 20 ft. long and 1 in. diameter, and we put two men on them to work the rods up and down in the pile until the rods reach the ground. We use a cast iron flue on the outside. This is about 4 in. at the top and about 2 in. at the bottom. It is placed over the rod and forced down in to the coal. We put a trench former over the top and press it right down and when they get that right down to the next hole they take out the former. They get a piece of tar paper and shape it like a funnel and it goes a few inches above the coal to prevent the water from filling up the hole. These holes last for two years in some cases. For Dominion coal we usually make the holes 2 ft. apart, but for the American coals we make them 3 ft. apart.

Chairman :

Do I understand that you have the holes about 2 ft. apart?

Mr. Pudney :

Yes, for the Dominion or Nova Scotia coal, but for the coal that comes from Pennsylvania we make the holes about 3 ft. apart. At Brownsville Junction we get West Virginia coal, and pile it 20 ft. high but it never heats and is not ventilated.

Mr. Battley :

I would like to ask Mr. Pudney if he piles slack coal 12 ft. deep.

Mr. Pudney :

We have slack coal piled at Hochelaga now that is 12 ft. high.

Mr. Battley :

Does it heat any quicker than the run of mine coal?

Mr. Pudney :

Yes, if stored when dry it is difficult to prevent it from heating. Last year we piled coal at Hochelaga 12 ft. high and had fires all over. I took the precaution to ventilate it every two feet and put pieces of pipe down about 3 ft. long before it got hot enough to catch fire. Between the holes we put a pipe down and kept moving it to saturate all the coal around, and we did not have any fire.

Chairman :

Coal is something that I know very little about but I am going to ask a question. For my information, what is the difference between hard and soft coals? I suppose that spontaneous combustion exists only in the soft coal.

Mr. Pudney :

Yes, principally, but we had a fire occur at Toronto several years ago in hard coal, although it was not what you call anthracite. Bituminous coal has from 30 per cent to 40 per cent of combustible gas while anthracite will have only from 2 per cent to 3 per cent volatile matter. In this case the coal contained about 18 per cent volatile matter, so that it was a semi-soft coal. Hard coal is nearly all fixed carbon and the sulphur in it is metallic and does not easily heat.

A Member:

I would like to ask what it costs to ventilate these coal piles per ton?

Mr. Pudney:

It costs us about 5 cents per ton. In the case of Dominion coals we have to make the holes about 2 ft. apart but the holes are easily made and the cost is about the same as the American coals in which the holes are placed 3 ft. apart.

Mr. York:

I have had considerable experience in storing coal in quantities of about twenty-five thousand tons, and we have been very successful in ventilating, although we probably have a cheaper method than that explained by Mr. Pudney. In our system we dig trenches part of the way across the pile about 6 ft. wide at the top and the width of a shovel at the bottom, which gives a V shaped trench about four or five feet, then another similar trench is made about 15 ft. from the first, and the coal thrown into a pile between the trenches. These trenches are continued every 15 or 20 ft. for the length of the pile. For the past five years we have had no fire or heating to speak of, with the exception of last year, we had some heating, but not any fire.

As regards sulphur—I have noticed that any portion of the pile containing more sulphur than the rest will be the first to develop heat. We have always adopted a system very similar to Mr. Pudney's of isolating a fire with water, should one occur. We use a 2 in. iron pipe 16 feet long, pointed one end and with a long sharp point. A series of holes are drilled around the pipe near the point and on the upper end a T is screwed with an ordinary plug in the top end of that, by this means the pipe can be driven down with a mallet if necessary. The plug is then removed and a thermometer inserted, when if the temperature indicates serious over heating or fire, we attach the male end of an ordinary fire hose with a suitable coupling to the center of the T. The radial holes in the bottom of the pipe then afford a perfect distribution of the water. Several of these pipes may be used and the house changed from one to the other where necessary.

I am satisfied that over ventilation is not a good thing for coal. I know of one case where a series of walls were built, the uprights being about the size of railroad ties and standing 20 ft. high. These were planked on both sides with

rough planks spaced about 1 1-4 in. apart. These walls were each 200 ft. long and were constructed side by side 20 ft. apart, over the top of which was constructed a drive way or platform onto which the carts would drive up and dump into the pockets or spaces between the walls. That system was used for about 20 years and I do not recollect a single year when several of these bins did not catch fire and blaze right up. They cost a great deal to maintain and I firmly believe assisted in setting fire to the coal through excess ventilation.

Mr. Pudney:

When we locate any heating we take out inch rods and drive them in the same way as if we were ventilating, to find out at what depth the heating exists. We put water right down to the bottom but when we get over to the fire we only put the rods in so that they can come to the fire. One man takes the rod and makes the holes and we let the water run around the trench and as this is done it will make channels of its own. Of course they can go over a lot of space because these rods are made so that it is not difficult to get them down, and we put the water screen around the rod without having to shift the hose.

Chairman:

Mr. York, I should like to ask if you have any difficulty in getting these pipes down through the coal? Do you put them down after the fire starts?

Mr. York:

No difficulty at all. They go down allright. Two men can put them down quite easily. The primary object is to ascertain the temperature in different parts of the coal pile. We watch the pipes closely and make a diagram of the pile and number the holes and note the temperature on the diagram every two or three days and thus have a record from year to year. As said before, if necessary, we can use these pipes for putting out a fire or for cooling over heated coal.

Mr. Wickson:

A lot of argument has been advanced about spontaneous combustion, the idea being that the heating occurs inside of the large volume of coal. I know of a case where smokeless coal was stored and instead of heating in the centre

it heated right along the edge of the pile close to the ground. In passing the pile you could see little nests of red coal. I could never find any explanation for it.

Mr. Pudney:

I made the statement in the paper that I had found fires close to the surface of the pile. We found that the test rods showed hot at the top but we could not find out where the fire was until we had dug in and then found it at the slope about three feet from the side. A small pile of coal is no insurance against fire if the proper conditions are there to produce fire any more than in the pile that has 100,000 tons, and in so far as fire breaking out at the outside of the pile is concerned, I have seen this in our slack pile which heated last winter and when we dug into it we found that the fire had started inside the pile and the finest coal was on the top, and the fire had worked its way out through the nut coal on the bottom because it was easiest to do so. A little fire would appear in one place today and in another place tomorrow and when we dug the fire out we found all over the bottom was three inches of ash which proved that the fire had worked its way out to the surface.

Mr. Wickson:

Another matter which bears out the contention as to sulphur being the cause of the fires is shown in the manufacture of gas. I do not know whether there are any gas manufacturers here but as you know, all coal contains sulphur and as it is against the law to permit any sulphur to exist in the gas which is distributed for household purposes it has to be purified; and this is done by the use of a purifier composed of iron rust mixed with shavings. The shavings are used so as to make the mass porous so that the gas will pass through the mass, and also to have a large amount of surface covered with the oxide exposed to the gas. They are enclosed in a cast iron box with removeable cover about thirty feet square with the "purifier" as it is called, piled about two feet deep on wooden grids. When the gas passes through this mass the sulphur is removed. From time to time the gas is tested to see if any signs of sulphur are showing and when this happens the "purifier" is considered "foul," and the boxes must then be opened and the purifier put out in the open to be revived. The purifier can be used over and over again being revived each time it becomes foul from use; but as it retains a percentage of fixed sulphur

each time, finally its usefulness as purifier is gone, and when it contains about 30 per cent of fixed sulphur it is sold to one of the chemical companies. When this purifier is taken out of the boxes and put in the open it will heat up very quickly on account of the sulphur meeting the oxygen of the atmosphere and men are required to turn it over continually until the danger is past. This may serve to bear out Mr. Pudney's statement about sulphur being the cause of fire in coal piles.

Mr. Battley:

Mr. Pudney, do you think it is feasible to wet down coal that is being put into stock where you have the facilities and the water supply?

Mr. Pudney:

That is a hard question to answer. If I was going to figure on preventing fire in a coal pile, and the coal was coming in bone dry, I would say that wetting it would be an advantage, as nine times out of ten where we have had coal fires it has been in some coal that has a little sulphur and is bone dry in the car. Where you open a pile and the sulphur fills the hole there is nothing else to do but keep trying it out until the coal takes fire itself. I was reading over a report of the U. S. Administration Fuel Committee. Of course that committee is composed of men who have been going around inspecting, but they have not handled coal. If they had handled coal as long as I have I think they would have different views on this subject. One of their arguments was to press down the coal to keep the air from going into it. All our experience has shown that we have the most trouble with coal heating where it is packed tight by the engine and cars passing over the pile. They also say that by putting pipes into the pile it would allow the atmosphere to get down into the coal but no one could convince me that where you see steam rising up the atmosphere was going down.

Chairman:

Have you had any trouble by coal heating while in transit in cars?

Mr. Pudney:

Practically we have not, but the locomotive foreman at Windsor was telling me that he had a car of Illinois slack

and when he examined the car he found the bottom of it on fire, but we used this Illinois coal and at one time had 25,000 tons of it on a dump at Windsor, and it did not give any trouble.

Mr. Hazen:

I would like Mr. Pudney to tell us about some experiments that were carried out at Outremont about six or seven years ago when they attempted to treat the coal as it went into stock with calcium chloride. At that time fuel economizers were being advocated and we were interested in them, and about the same time another chemical scheme was brought forward for overcoming the accumulation of heat in a coal pile and was tried out. I believe it was a solution of soda ash. I think Mr. Pudney had some interesting experiences in this.

Mr. Pudney:

I might say that these tests were not under my personal supervision although I knew about them. The fuel economizer was used principally on locomotives so that they would not use so much fuel. They succeeded in burning up the fireman's clothes, tools and outfit but we did not get any benefit from it. With respect to the soda ash, we had trouble with fires and Prof. Hersey sent down some soda ash which we applied by pouring it down into a hole made at a point where the coal was heating, but in two weeks time the fire broke out again in the same spot and when we took the coal out the whole area was saturated with iron rust. We could not do anything with it and it did not seem to have any good effect like water. There were also some tests made in 1910 on the Abattoir Dump. The Government had something to do with it, also the Grand Trunk and the Dominion Coal Co. were interested. I never saw any report of the results but I imagine they found something like circulation of air in it which I presume was only the heated vapor underneath coming through the vent holes.

Mr. Cunningham:

Mr. Chairman, the thanks of this club are due Mr. Pudney on two counts. First for having prepared such an interesting paper and then for starting something upon a subject about which there is altogether too little said and written.

The University of Illinois issued their circular No. 6, a very interesting paper, on the 'Storage of Bituminous Coal.'

There is also the document which Mr. Pudney has referred to as issued by U. S. Federal Fuel Administration. Both documents are of great interest to those responsible for the handling and care of stored coal.

Some years ago I was placed in charge at a coal fire at Hochelaga. We followed the usual method as outlined in Mr. Pudney's paper—that is, we ran a trench through to separate the good from the heated coal and cut the latter off; we loaded out from the heated area and when it became too hot used the hose and loaded again until it was all moved. Ventilation of dumps was resorted to by cutting channels through the coal with slip scraper and horse—we made boxes using 2 x 12 full length plank without ends with 2 in. holes bored in sides. These holes were covered with netting to prevent the coal from getting in and closing up the air passage. The boxes were set vertically and spaced in the dump when it was being built. Top openings of boxes were covered with a piece of canvas or old sacking. Inspection was periodically made at the boxes and if the dump showed signs of heating the area was opened up with a shovel or with a horse and scraper if necessary and we dissipated the heat. In this way we were able to keep the fire out.

When connected with a large western coal company one of the banes of my life was the slack coal dump which was alongside of a large stock of timber which I was responsible for. There was no market for the slack coal and invariably the piles caught fire from latent causes. New dumps were made, all of which had same result. This gave excellent opportunities for study and observation. The slack coal was then of no value, so no attempt was made to conserve it.

In the Crows Nest Pass, fires have, to my knowledge broken out in two bituminous mines, one of which burned for some years. The way to deal with that condition was to seal it up so as to exclude the air and let it die for want of oxygen.

There is a coal pile about 40 feet high (or deep) at the mouth of a coal mine slope south of Pincher Creek, Alberta, which showed no signs of heat for two or three years.

I was very fortunate to have been placed in charge of a fire fight in a coal pile at Fort William last winter, which contained about half a million tons and with reference to theories or methods of dealing with fires in general it might be of interest and useful to relate a few experiences. Mr. Pudny, the author of tonight's paper was with us most of the time and rendered valuable assistance. The affected

area was about 1000 feet long 600 feet through, cut by the two overhead bridge tracks—the main body of coal was 400 feet through and mostly 40 feet deep. A slack pile of about 60,000 tons at the east end gave evidences of heat. I opened up this pile, somewhat against the wishes of those on the ground, as it was feared that this action would expose the pile to destruction. The operation worked out splendidly, that is, the dump was caught before ignition and opening up exhausted the heat. This simply proved that where there is heat, open up the pile and let it exhaust. If you “get it” soon enough there will be no loss. It was on the outer edges alone where we did not open up, that fire developed in the slack dump. The actual coal loss was negligible.

In the main pile the coal was forty feet high, because of the unusual conditions under which it was rushed in under war restrictions of the U. S. Administration. Delivery of the coal had to be taken when it was available and it was a case of “do it quick” or “go without” owing to the late navigation conditions. It may be interesting to state that all of the fires until pretty near the end of the fight developed along the toe of the slope and in the open or coarse coal.

In connection with methods of handling heating coal I would refer to U. S. Fuel Administration document already mentioned. The title of the joint paper is “Spontaneous Combustion of Coal,” by H. H. Stock and W. D. Langtry. On page 5 it says: “It will always be seen that the lump coal naturally rolls to the outside of the pile, if the coal is built up in a pile of any height. This should be avoided for it permits an accumulation of fine coal in spots and the larger pieces of coal may form a chimney for the admission of air between the large lumps to the smaller coal in the interior of the pile.” I demonstrated this to be absolutely true. We had to fight an average of forty fires a day. These fires were separate and distinct. To this discovery may be attributed the fact that our loss was kept low and we were saved from disaster. The whole area was divided into two fire districts and a fire force organized to take care of the fires in each district.

Perhaps I ought to say that Mr. Pudney’s water screen did not appeal to me, probably due to extreme size of dump. The method followed was to use water at high pressure, working on the old principle, which all fire departments follow, that it is a good thing to put water at the root of

the fire to put it out, this high pressure water made it possible to wash the hot coal out of the dump, quench and cool it, leaving nothing but a cool surface behind where the fire had been. We gave attention to each fire as fast as we could get to it and treated each fire in the same way, using the hose as a monitor or giant and sluicing the fire out. It became entirely a matter of firefighting and much anxiety was relieved after the "spot fire" condition was discovered. One night in particular (Christmas Eve) the wind was very high, about sixty miles an hour, with temperature 46° below zero, we had an awful fight—several of the men were badly frozen and gassed. I was bitten three times in a very few minutes. This stretch for me extended over sixty hours. On another occasion the high winds brought on a very formidable condition about two a.m., tongues of blue fire were coming up through the top of the main pile. We got a stream up there. We used plenty of water, but could not put the fire out. As fast as the stream travelled over the surface it lit up again, the seat of the trouble proved very hard to locate. Gas was rising from effects of a fire in the pile lower down on the exposed western slope and the wind was carrying the gas through to the top where it ignited. We immediately tackled that fire spot below and washed it out and the trouble on top subsided. Had the cause not been removed no doubt the gas flames would have ignited the top coal and we would have had an even more interesting time.

In dealing with a coal dump, heat will be in evidence when the coal is from 100 to 200 degrees, the point of ignition will not be reached until the temperature rises three or four times higher than that. There is ample notice and time to apply remedial measures and so ward off the fire and necessity to fight it. The men were called upon to perform the seemingly impossible over and over and responded splendidly and the final results were very gratifying. While the fire was being held, the work of loading out was being hustled along with the company's magnificent coal handling equipment on the Fort William Island dock.

By co-ordinating different units it was possible to pick up and load out of the pile very rapidly. Our maximum and record loading was 164 carloads in one day of 24 hours. The work done by the force was beyond praise against extreme cold, smoke, gas and water. It was above and beyond any call of duty. The handling of water in fire hose at those low temperatures would make a chapter in itself. We pumped

the water from Lake Superior after cutting holes through the ice.

During the course of the fire a number of suggestions and methods were offered—some rather unique—one was urged, to use a chemical which would develop gasses to arrest combustion. I chose a most favorable day and spot. The rising heat carried the gas away and fire burned right along. Another was to drive pipes in and flood the interior of the pile, as mentioned. The fires developed on the surface.

I said I was fortunate in being placed in charge of that great work, which while making the heaviest drain upon ones physical resources was interesting in that we were conquering the combined elements and saving from destruction during war time that which could not be replaced for another year if lost. This and the full backing of the management left no room for greater incentive. The loss was low.

The opening paragraph of the U. S. Fuel Administration paper already referred to makes the bold statement:

“There is no excuse for property loss due to spontaneous combustion of coal. The process of oxidation of coal is slow and there is ample time to find out if a coal pile is heating, and if so, to move it before the pile actually takes fire.”

Mr. Chairman, I believe that is correct. I thank you.

Chairman:

If there is no further discussion I will ask that someone propose a vote of thanks.

Mr. Cunningham:

I think it would be in order for me to move that vote of thanks and I take pleasure in doing so.

Mr. Battley:

I second that.

Chairman:

It has been moved and seconded that a vote of thanks be tendered to Mr. Pudney for his interesting paper. All in favor please signify—carried.

Mr. Pudney, on behalf of the club I wish to extend our thanks for your paper. I am sure it was enjoyed by everyone, and I personally found it very interesting.

The secretary tells me that at our next meeting we will have a paper with illustrations on the manufacture of varnish

Mr. Holland, will you explain to the members just what kind of a paper is to be given?

Mr. Holland:

It is a paper written on the manufacture of varnish and paints. There are about 125 slides which illustrate the methods followed all over the world from late B.C. down to the present day.

Chairman:

If there is no further business we will stand adjourned until next meeting. Members and friends will find coffee and sandwiches in the ante-room, and I hope everyone will stay.

SIXTEENTH ANNUAL DINNER.

The Club's Sixteenth Annual Dinner was held at the Windsor Hotel, Montreal, on Saturday the 25th January, 1919.

Mr. T. C. Hudson (President) was in the chair. Among the guests at the president's table were: Brig. General Sir Alexander Bertram, Mr. Grant Hall (Vice-President of the Canadian Pacific Railway, Major S. J. Robins, Messrs. J. F. Harrison, J. Hendry, E. E. Lloyd, R. M. Hannaford, C. H. N. Connell, H. H. Vaughan, A. A. Maver, H. Osborne, E. A. Nix, A. Crumpton, G. T. Bell, Lt.-Col. J. W. Harkom, F. A. Purdy, E. T. Thompson, C. N. Gray, H. J. Dyke, F. N. Adams and James Powell.

Mr. Grant Hall responding to the Toast of "The Railways," said:

"During the past year or two the railways of the United States and Canada have been subjected to a great deal of criticism, and perhaps some of them are partly to blame for this.

You must remember that railway work is a vast affair, divided into many departments, and you must have experts for each department. But never forget that our business is transportation. We are in business to move goods, and to deliver them as quickly and cheaply as we can."

Mr. Hall discussed Government ownership of railways, explaining that it was a ticklish subject, but that he had been challenged to say something about it.

"I do not know that it would be good taste for me to say much about this matter," said Mr. Hall, "but let me say that it might be well for us to consider it, lest we make a mistake. I will only say that our problem is to make this country cheap and safe for everyone to live in. Then we shall get the population, and if we can get the population we shall be able to pay our debts, which is what we have to do.

"A nation is made, not by its fruitfull acres, but by the men who cultivate them; not by its great forests, but by the men who use them; not by its mines, but by the men who work in them; not by its railways, but by the men who run them. America was a great land when Columbus discovered it, but Americans have made of it a great nation, and our people have made of Canada the country that it is, and that it is going to be." (Applause).

Major S. J. Robins responded to the toast of "Our Guests." The two points of his address were that people were today living in the most wonderful age the world had ever known, and that Canadian were living in a wonderful country.

"Democracy is coming into its own," said Major Robins, "but there is danger that its power may be abused. This applies particularly to the Bolshevik tendency of certain people who claim to represent labor, which tendency must be nipped in the bud or it will spread its poison through the whole economic system, and the task of nursing back the labor world to health will be difficult, if not impossible, to accomplish. Bolshevism means the repudiation of national obligation, and those of the great mass of industrious and thrifty toilers of this country, who with their hard-earned wages, bought Canadian Victory Bonds, could throw them away as mere scraps of paper if Bolshevism were to prevail here." (Applause).

This was the era of the young man, said Major Robins, and in evidence of this he paid a warm tribute to Mr. E. W. Beatty, who had become president of the Canadian Pacific, one of the greatest industrial positions in the world, while still a young man.

Brief speeches followed from Mr. Harrison, President of the Commercial Travellers' Association; Brig.-General Sir Alexander Bertram, for the Railway Supply Men; Mr. V. G. R. Vickers, for the Express Companies, Mr. Norman Holland, and others.

There was an attendance of over 175 members and friends

present. The speeches were interspersed with music and singing by a number of capable and amusing performers, and it was generally agreed that the dinner was one of the most successful functions in the Club's history.

J. J. HARTY

DIED

January 22nd, 1919

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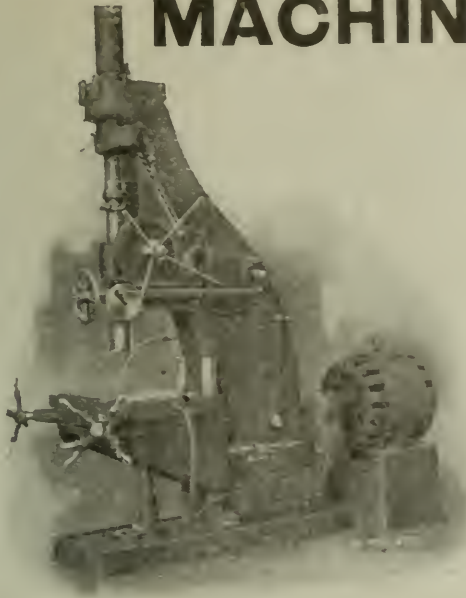
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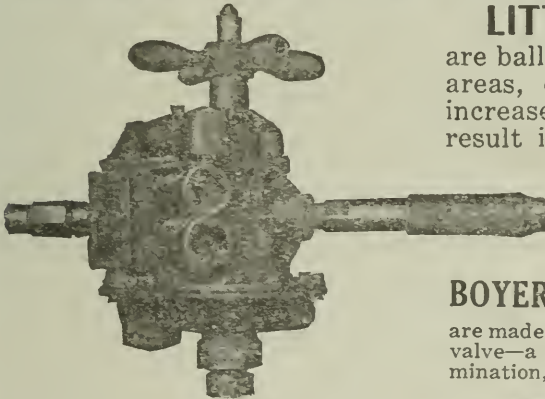
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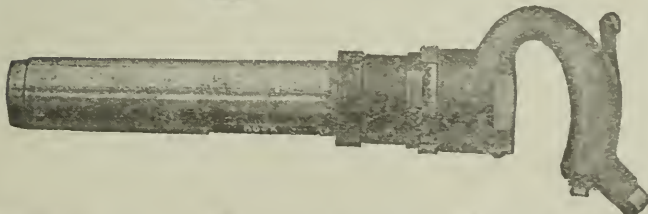
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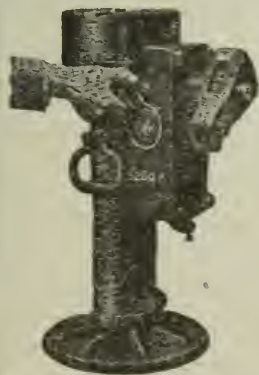
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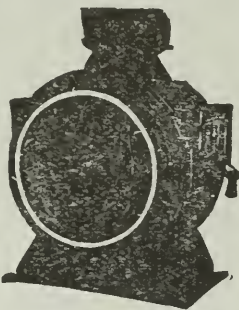
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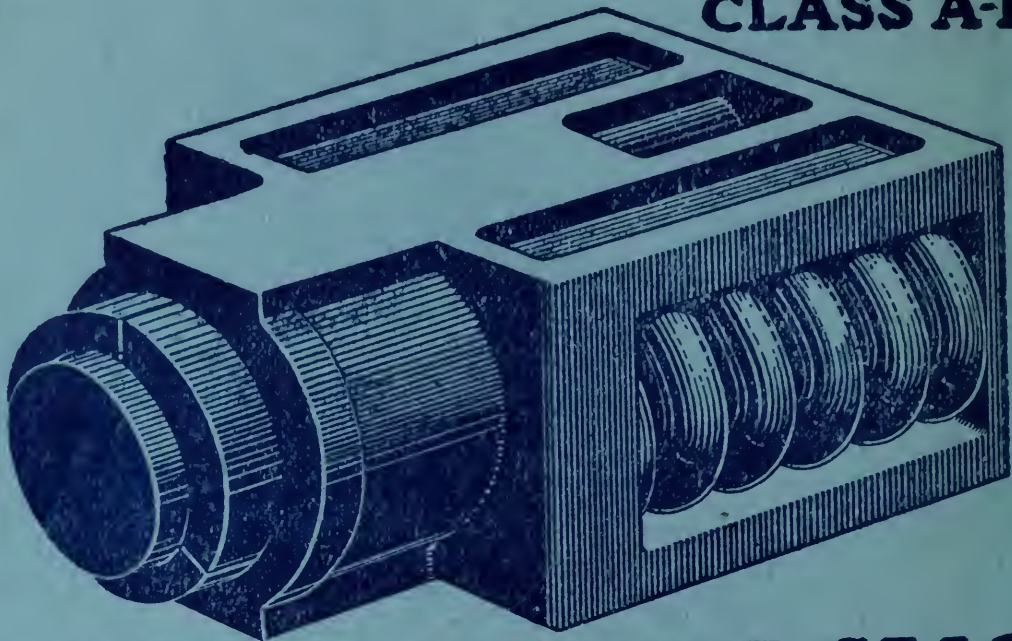
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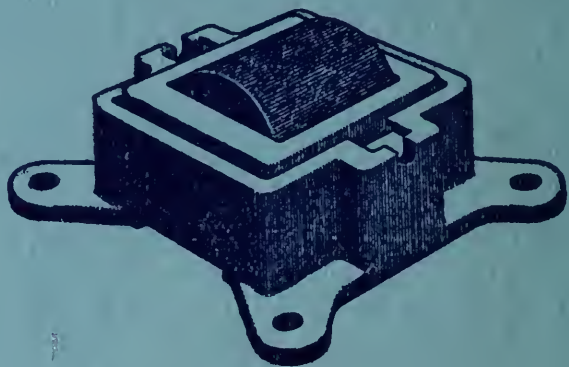
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